The Use of Puzzle Learning Media to Improve Student Learning Outcomes in Science Subjects for Class IV

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Info Article	Abstract
	This study aims to determine the effect of using puzzle-based learning media on student learning outcomes in science subjects, especially in Class IV of 3 Simbarwaringin State Elementary School. Faced with low student involvement and traditional teaching methods, this study aims to determine whether puzzle media can improve student learning efficiency and understanding. This study was conducted in the form of classroom action research and implemented in two cycles, each of which includes the stages of planning, implementation, observation, and reflection. Data collection was carried out through observation, testing, and documentation. The results of the study showed a significant increase, namely an increase in student learning achievement from 56.26% in the first cycle to 81.25% in the second cycle. This finding indicates that puzzle media not only motivates students but also increases students' focus and cognitive engagement in science subjects. The novelty of this study lies in the effort to demonstrate the effectiveness of interactive media in elementary science education, which offers valuable insights for educators who want to develop an active learning environment. In conclusion, the puzzle-based approach has been shown to be beneficial for student performance, thus reinforcing the need for diverse media in elementary education. Keywords: Elementary; Learning Media; Learning Outcomes; Science Education

INTRODUCTION

The learning process requires a conscious process that tends to be permanent and changes behavior (Drigas et al., 2022; Picione, Raffaele De Luca & Lozzi, 2021; Thiermann & Sheate, 2021). In this process, information is remembered which is then stored in memory and cognitive organization. Furthermore, these skills are practically manifested in the activeness of students in responding and reacting to events that occur in students or their environment.

Science is one of the subjects taught from elementary school to high school. Natural science is a collection of systematic theories, its application is generally limited to natural phenomena, born and developed through scientific methods such as observation and experimentation and demands scientific attitudes such as curiosity, honesty, and others. Science is essentially a science that has special

characteristics, namely natural science has scientific value, meaning that the truth in science can be proven again by everyone using scientific methods and procedures (Hanif, 2020; Simanjuntak et al., 2022). Natural science also discusses natural phenomena that are arranged systematically based on the results of experiments and observations made by humans. Science in elementary schools/Islamic elementary schools emphasizes providing direct learning experiences through the use and development of process skills and scientific attitudes.

Based on the results of pre-survey observations at 3 Simbarwaringin State Elementary School on February 12, 2019, it was found that many students felt bored and tired of learning Natural Sciences because the strategy used was only centered on the teacher, students only listened to the teacher explaining the material and doing assignments. So it seems that the teacher controls the learning in the classroom, this is the result of the observation showing that student learning outcomes are low (Cilliers et al., 2022; Putra, 2021). Teachers are less varied in using learning media or the learning media used are not appropriate for the material, student interest in learning is also reduced, in fact the results.

In line with previous research that discusses the implementation of creative learning media to improve student learning outcomes, but there is a fairly interesting gap in the approach and field of study taken (Winarto et al., 2020). Previous research focused on the use of card-based learning media for Mathematics subjects, which tend to require a logical approach and critical thinking. Meanwhile, this study emphasizes the use of puzzle media for science lessons, which are more visual and exploratory in understanding scientific concepts.

Based on the gap analysis in the two studies above, there is a gap that each media has characteristics that are appropriate for different types of lessons; card-based media may be more effective in helping to understand numerical concepts in Mathematics, while puzzle media can be more useful for science learning that requires an understanding of the structure and relationship of concepts (Ningsih & Sari, 2021). This comparison also indicates the importance of choosing learning media that are appropriate to the characteristics of the subject and the cognitive needs of students.

Based on the gap analysis of the two studies, the novelty that can be offered is the development of learning media that combines the advantages of card and puzzle media to create a more holistic and adaptive learning approach (Indah Septiani et al., 2020; Thiermann & Sheate, 2021). By integrating the visual and logical aspects of both media, students can be helped to understand complex concepts through multi-sensory involvement, both for lessons that require critical analysis such as Mathematics and those that are explorative such as Science. This approach not only enriches students' learning experiences, but also offers variations in more flexible learning methods to adjust to the characteristics and specific needs of each subject, so that it can increase the effectiveness of learning as a whole (Fitria, 2022).

These findings indicate that the use of puzzle-based learning media can be an effective tool to improve students' engagement and understanding in elementary science learning.With significant improvements in learning outcomes from the first cycle to the second cycle, teachers can consider incorporating interactive media such as puzzles into the curriculum regularly as part of the learning method (Jainal & Shahrill, 2021; Qutieshat et al., 2022). These implications indicate that interesting and motivating learning media can improve the process of understanding complex materials, as well as help students be more focused and motivated during learning, especially in lessons that require conceptual understanding such as science.

The urgency of this research lies in the need to address the low engagement and understanding of students due to traditional teaching methods. By switching to interactive learning media such as puzzles, elementary education can be more effective in fostering students' interest in learning and significantly improving learning outcomes (Hirdina Sartika Dwi Yunita Amelia Putri, 2022; Sartono et al., 2022). This urgency is increasingly relevant in an era of education that demands innovative approaches to attract the interest of the younger generation and help them build basic skills with more fun and relevant methods.

Therefore, it is necessary to conduct research that is expected to be able to influence student learning outcomes in Natural Science learning through the use of puzzle learning media. The selection of the right media can have an impact on the relevance of students to a learning (Mansur & Utama, 2021; Marpanaji et al., 2018). For science learning, the selection of media must be adjusted to the material to

be delivered. One of the right learning media to use in science lessons is puzzle media.

RESEARCH METHODS

Research Design

This study uses a qualitative approach with a Classroom Action Research (CAR) design (Evendi & Verawati, 2021; Suhirman & Rahayu, 2021). The main objectives of this study are to address practical problems faced in the classroom and to improve teachers' learning activities as part of their professional development(Hakim, 2020). CAR was chosen to help teachers identify and solve real classroom problems, as well as to improve student learning outcomes using puzzle-based learning media(Furner, 2018; Indahri & Djahimo, 2018). This research was conducted in two cycles during one period, specifically targeting science classes at 3 Simbarwaringin State Elementary School, focusing on Grade IV. Each cycle consists of planning, action, observation, and reflection phases.

Research Target/Subject

The subjects of this study were students of Grade IV of 3 Simbarwaringin State Elementary School. This selection was based on the needs observed in this particular class, where traditional teaching methods limited student engagement and learning efficiency (El-Sabagh, 2021). The entire class participated in this study, allowing for comprehensive data on the effectiveness of puzzle-based media.

Research Procedure

This study follows the Classroom Action Research (CAR) model conducted in two cycles (Nashruddin et al., 2018; Nurtanto et al., 2020; Sinaga et al., 2021). Each cycle includes four steps. First, planning, developing lesson plans and puzzle-based learning activities designed to increase engagement in the science curriculum. Second, implementation, carrying out lesson plans and integrating puzzle media into teaching sessions. Third, observation, monitoring student engagement, participation, and understanding during lessons, which are recorded through observation sheets. Fourth, reflection, analyzing student outcomes and teacher observations after each cycle, leading to adjustments in teaching approaches for the next cycle.

Instruments, and Data Collection Techniques

Data were collected using several instruments, first observation, to monitor student engagement and participation (Nkomo et al., 2021; Salmela-Aro et al., 2021). Second test (Formative assessment), to assess student learning outcomes before and after each cycle. Third documentation, Recording student scores and observations. Data was collected through formative assessments, specifically designed to align with standard learning outcomes, with passing criteria set at a score of ≥ 66 according to the minimum passing criteria for science subjects at this grade level.

Data analysis technique

Data analysis techniques involved both qualitative and quantitative approaches (Taherdoost, 2022). Observational data were analyzed qualitatively to assess changes in student engagement and behavior over the cycles. Test scores from each cycle were analyzed quantitatively to measure improvements in learning outcomes, calculated as the percentage increase in student achievement from the beginning to the end of each cycle. The findings were then compared to the learning objectives, to evaluate the effectiveness of puzzle-based media in improving science education (Chayani, 2021).

RESULTS AND DISCUSSION

The learning process in this study was carried out in 2 cycles and each cycle consisted of 3 meetings. The first stage of this study is planning, before carrying out this planning stage, the researcher conducted an initial reflection which aimed to determine the class conditions and circumstances in class IV of 3 Simbarwaringin State Elementary School, Trimurjo District. The results of the initial reflection obtained information that the number of students in class IV was 16 students consisting of 7 male students and 9 female students. Meanwhile, related to science learning at 3 Simbarwaringin State Elementary School, it has been running well, but teachers are still lacking in making variations in learning, teachers only convey material verbally and very rarely use media.

Based on the results of the pre-survey data, it is known that the learning outcomes of students who have not reached the minimum passing criteria are 8 students with a percentage of 50% while the learning outcomes of students who have reached the minimum passing criteria are 6 students with a percentage of 37%. The low learning outcomes are due to the lack of student learning activities in science subjects. The low learning outcomes are thought to be due to the lack of student involvement in learning Natural Sciences, students are less active in the learning process and learning is only centered on the teacher and without using learning media. This situation requires creativity in managing learning activities in the classroom including the use of learning media. The learning process does not only require learning resources from books, but also learning media that can support the learning process. Learning media are needed so that students can be interested and impressed with a learning, so interesting and not boring learning media are needed.

This study uses classroom action research (CAR). The purpose of this study is to determine the improvement of science learning outcomes of grade IV students of 3 Simbarwaringin State Elementary School by using puzzle learning media. This study was conducted in 2 cycles and each cycle consisted of 3 meetings, each meeting consisting of 1 lesson hour (30 minutes) at each meeting. The description of activities in each cycle is as follows.

Cycle 1, At the last meeting in each cycle, students are given test questions with the aim of determining the level of student success in learning activities. Assessment of student learning outcomes is based on cognitive abilities. The data on learning outcomes for grade IV science subjects are as follows.

Table 1. Science Subject Learning Outcomes Cycle I.

No	Analysis Components	Cycle I	
		Pree Test	*Post Test*
1.	Jumlah	830	1080
2.	Average	52,50%	67,5%
3.	Highest Value T	80	100
4.	Lowest Value	20	50
5.	Total Completed	3	9
6.	Incomplete Amount	13	7
7.	Level of Completion	18,75%	56,25%

Table 1. It can be seen that after the implementation of learning using media during one cycle with 3 meetings, the results of student learning completion increased from pretest to posttest. From the results of student learning completion in the implementation of the pretest, data was obtained with a total value of 830, with an average of 52.50%, the highest value of 80 and the lowest value of 20, the number of students who completed was 3 students named Anis P, Arina I, M. Fadillah and those who did not complete were 13 students named Dika A, Faik S, Delvani S, Deva AA, Frazia AR, Lutvia H, Marsha N, M Rafka R, Rifqi A, Shafa A, Vena V, Adiya B, Revan DW, so that the completion rate was 18.75%. From the pretest results, it can be seen that the average student has not yet mastered and understood the lesson material, which is only 52.50%. After students followed the learning process using puzzle media for one cycle with 3 meetings, the results of student learning completion increased with a total score of

1080, with an average of 67.5%, the highest score of 100 and the lowest score of 50, the number of students who completed was 9 students named Dika A, Anis P, Arina I, Frazia AR, Marsha N, M Rafka R, M Fadillah, Shafa A, Aditya B, Revan DW and 7 students named did not complete it Faik S, Selvani S, DevA AA, Lutvia H, Rifqi A, Vena V so that the completion rate was 56.25%. In this first cycle, the average student learning outcomes reached the target, which was 69 above the Minimum Completion Criteria with a value of 65. However, the classical completion percentage had not met the success indicators that had been set, which was 70%, while in the first cycle it still obtained 56.25%.

The final stage of cycle I is the reflection stage, research and collaborators thoroughly review the actions that have been taken, based on data that has been collected in cycle I, both from pretest, posttest, teacher activities during the learning process. At the end of cycle I, data was obtained that student learning outcomes increased from each meeting, but the learning process was still less than optimal. From the results of observations on the teacher's activity sheet, there are several things that need to be considered, namely. First, the teacher is lacking in providing apperception and motivating students, has not and is lacking in actively participating in learning. Second, the teacher is lacking in providing feedback and reinforcement to students. Third, the teacher is lacking in guiding students to dare to convey the results of their group discussions. And finally, the teacher is lacking in directing students to make conclusions at the end of their learning.

At the end of cycle I, the post-test data of students were obtained which were used to measure student learning outcomes, namely 56.25% of students had achieved learning outcome completion and 43.75% of students had not achieved learning outcome completion. Based on the results of reflection in cycle I, there were weaknesses for improving the implementation of cycle II, namely as follows. First, in learning, teachers must be able to provide motivation to students who are less active and lazy in participating in learning activities. Second, teachers must provide feedback and reinforcement to students. Third, teachers must guide students to participate actively in discussions and dare to convey the results of discussions. And guide students in drawing conclusions from the results of discussions presented by their friends. Teachers must be able to stimulate students to make final conclusions at the end of learning.

Cycle 2. Because there are still some things that need to be improved, cycle II is needed. Based on the reflection of cycle I which still needs improvement in the learning process, cycle II is implemented. The stages in cycle II are the same as cycle I, namely: planning, implementing actions, observation, and reflection. However, the material in cycle II is not exactly the same as cycle I for each meeting. Assessment of student learning outcomes is based on students' cognitive abilities. Learning outcome data is shown by the pretest and posttest at the end of the cycle given to the following 16 students.

Table 2. Science Subject Learning Outcomes Cycle II

No	Analysis Components	Cycle II	
		Pree Test	Post Test
1.	Amount	1130	1315
2.	Average	70,62%	82,18%
3.	The highest score	100	100
4.	Lowest Value	60	60
5.	Total Completed	12	13
6.	Incomplete Amount	4	3
7.	Level of Completion	75 %	81,25%

From table 2. It can be seen that after the implementation of learning using puzzle learning media for one cycle with 3 meetings, the results of student learning completion have increased. From the results of student learning completion in the implementation of the pre-test, data was obtained with a total value of 1130, with an average of 75% of the highest value of 100 and the lowest value of 60, the number of students who completed was 12 students named Anis P, Arina I, Deava A, Delvani S, Dika A, Kutvia H, Marsha N, M Fadillah, M Rafka, Revan, Shafa A, Vena V and 4 students named did not complete it Aditya

B, Faik S, Frazia A, Rifqi A so that a completion rate of 75% was obtained from the results of the initial student measurements. It can be seen that on average the students are quite good, but there are still some students who do not understand the content of the material presented by the teacher. After students learned about the learning process during one cycle with 3 meetings, the results of student learning completion increased with a total score of 1315, with an average of 82.18%, the highest score was 100 and the lowest score was 60, the number of students who completed was 13 students named Anis P, Arina I, Deava A, Delvani S, Frazia A, Lutvia H, Marsha N, M Fadillah, M Rafka, Revan Dwi W, Shafa A, Vena V and 3 students named did not complete it Aditya B, Faik S, Rifqi A so that the completion rate is 81.25%. In this second cycle, student learning outcomes have reached the target and the increase in the percentage of classical learning completion of students has met the Minimum Completion Criteria standard with a value of ≥ 66 reaching 81.25% at the end of the cycle. Which has exceeded the specified target of 70%.

Based on the results of the actions in cycle II, it is known that there are no more problems and obstacles in the learning process, where students have been able to follow the learning activities well. During the teaching and learning process, the teacher has carried out all learning well, so that the learning outcomes obtained by students have reached the targets determined in this study. The shortcomings in cycle I have been improved and increased in cycle II so that they are better. Students are more active in the learning process. The Learning Implementation Plan has been implemented well and has not experienced any disruptions that could change the original plan of this study. There is an increase in student activity and learning outcomes that have met the target so that the cycle stops in cycle 2.

Based on previous research that has been conducted Picione, Raffaele De Luca & Lozzi (2021), there is a gap in the form of learning media showing significant differences between the use of Canva in Mathematics and puzzles in Science. Canva, as a visual digital media, is considered effective in helping to understand abstract concepts with interesting interactive features, while puzzles, as physical media, encourage hands-on activities and student involvement in conceptual learning. The research methods are also different, where the Canva research is descriptive qualitative based on literature studies, while the puzzle research uses a Classroom Action Research (CAR) approach with a direct observation cycle in the classroom. The results of the study showed the effectiveness of Canva in increasing interest and understanding of mathematics theoretically, while puzzle media has been shown to significantly improve science learning outcomes through the learning cycle. The learning implications of these two media show that Canva provides variation in conveying abstract concepts, while puzzles increase student activity and understanding in real terms in learning.

The novelty of the results of this study lies in the comparison of the use of interactive digital learning media Canva and physical manipulative media puzzles in different learning contexts. Canva shows effectiveness in visualizing abstract Mathematics material through various digital features, which is in line with the needs of technology-based learning. Meanwhile, puzzles as physical media in Science show advantages in increasing active student engagement and conceptual understanding through a hands-on approach. This study offers a new perspective that the effectiveness of learning media depends not only on the type of media (digital or physical) but also on the suitability of the media to the characteristics of the teaching material and learning objectives, and shows that the right combination of media can improve the quality of learning in various disciplines.

From the results and discussion of the research conducted, there are implications that emerge, namely showing that the use of puzzle learning media can significantly increase student engagement, and contribute to improving student learning outcomes, especially in science subjects. The application of more interactive learning strategies and better motivation can encourage student participation, which is reflected in the increase in learning outcomes from Cycle I to Cycle II. Therefore, the use of appropriate media and effective learning techniques such as providing constructive feedback and strengthening motivation can improve the quality of learning and facilitate the achievement of students' academic targets.

The limitation of this study is that the application of puzzle learning media was only carried out in science subjects and was limited to fourth grade students of 3 Simbarwaringin State Elementary School. This makes the results of the study less generalizable to other subjects or to other classes with different levels of ability. In addition, although there was a significant improvement in Cycle II, external factors that

affect student learning outcomes such as parental support, socio-economic conditions, and other educational facilities cannot be controlled in this study (Hermino & Arifin, 2020). These factors can be influential variables but are not the main focus of this study..

CONCLUSION

Based on the results of classroom action research and the discussion that has been presented, it can be concluded that learning by using puzzle learning media can improve students' learning outcomes on animal life cycle material in grade IV in science subjects at 3 Simbarwaringin State Elementary School with an increase in student learning outcomes in cycle I of 56.25% and in cycle II the completeness of student learning outcomes reached 81.25% which means that the target has been achieved, namely the minimum passing criteria value of >65.

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And researchers recommend for further research by expanding the use of puzzle media to other subjects, such as Mathematics or Indonesian. Research can involve larger and more diverse groups of students, and consider external factors that influence learning outcomes. In addition, the development of technology-based learning media, such as interactive applications or educational videos, can be compared with physical media. A combination of interactive teaching methods, such as group discussions and project-based learning, is also recommended to improve student learning outcomes..

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